USER'S MANUAL
Rev. 12/2004

CD3000S-3PH
THYRISTOR UNIT

From 125A to 500A

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CD3000S-3PH Thyristor Unit from 125A to 500A

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CAUTION

Thyristor units are used in power industrial equipment. When the thyristor unit is working, there are on the unit the following voltages
- Maximum main supply voltage on power terminals up to 600V.
- Auxiliary supply 230-460Vac.
- Fan voltage 230Vac 50/60Hz Power consumption 14W.

Don't remove the plastic cover which provides adequate protection against electric shock.
Don't use this thyristor in aerospace and nuclear application.

Electric Shock Hazard (Risque the choque électrique)

When thyristor unit has been connected to main supply voltage and is switched off, before to touch it be secure that the unit is isolated and wait at least one minute to permit to discharge internal capacitors. Thus be secure that:
- access to thyristor unit is only permitted to specialized personnel;
- the authorised personnel must read this manual before to have access to the unit;
- the access to the units must be denied to unauthorized personnel.

Important warnings(attention)
- Local regulations regarding electrical installation should be rigidly observed.
- Safety regulations must be rigidly observed.
- Don't bend components to maintain insulation distances.
- Protect the units from high temperature, humidity and vibrations.
- Don't touch components to prevent elettrostatichal discharges on them.
- Verify that all ratings are in line with real needs.
- If authorized personnel must measure voltage, current etc. on units, take away rings and other jewels from fingers and hands.
- Authorized personnel working on thyristor unit under power supply voltage must work on insulated board. Be secure that board is not connected to earth.

This listing does not represent a complete enumeration of all necessary safety cautions.

Protection(protection)
CD3000 thyristor family has a polymeric plastic cover in compliance to International specification IP20. To understand if IP20 protection is sufficient should be evaluated the installation place where the units are installed.
Open Type Equipment(équipment de type ouvert).
Maximum surrounding air temperature 40°C(Temperature de l'air environnante maximum 40°C).

Earth(terre)
CD3000 family has isolated heatsink. For safety connect the heatsink to earth to avoid shocks in case that circuit board or thyristors lost insulation. Earth impedance should be correspondent to local earth regulation. Periodically the earth efficiency should be inspected.

Electronic Supply(alimentation électronique)
CD3000 family electronic circuit should be supplied by dedicated voltage supply for all electronic circuit but not in parallel with contactor's coil, solenoids and other inductive or capacitive loads. It's recommended to use a shielded transformer.

Electromagnetic compatibility (compatibilité électromagnétique)
Our thyristor unit has an excellent immunity to electromagnetic interferences if all suggestions contained in this manual are respected. In respect to a good Engineering practise, all inductive loads like solenoids contactor coils should have a filter in parallel.

Emissions (emission)
All thyristor switching at high speed generate some radiofrequency disturbance. CD3000 serie complies with EMC rules for CE mark. In many installations near electronic devices has not been noted problems. If radiofrequency device at low frequency are used near the thyristor unit, some precautions should be taken like line filters and shielded cables for input signal and for load cables.

C UL US
LISTED

CE

NOTE
We reserves the right to apply modifications to the our products without any advice.

1. Glossary

1.1 Terminology

V: voltage power supply.
I: the full circulating current in thyristor unit.
P: total load power.

1.2 Input signal

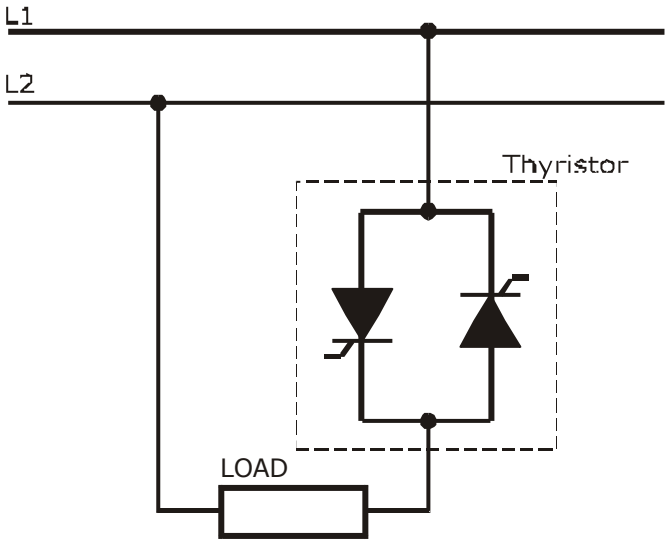
SSR: This input type is a square waveform generated by a temperature controller.
AN: Analog input.
IRS: Communication command.

1.3 Power feed back

Feedback: supply voltage fluctuation changes the power to the load. To overcome this effect the voltage supplied to the load is measured and compared with power demand from controller, the error signal is used to automatically hold the power at demanded level.

1.4 What is a thyristor unit

A thyristor unit is semiconductor device which acts as a switch formed by two thyristors in antiparallel. To switch on the alternating current the input signal will be on and the thyristor will switch off at first zero crossing voltage with no input signal. The benefits of thyristor units compared with elettromechanical contactors are numerouses: no mooving parts, no maintenance and capacity to switch very fast. Thyristors are the only solution to control transformers and special loads that change resistance with temperature and with age.



2. Technical specifications

2.1 General Features:

Operating temperature	0÷45°C for higher temperature see derating curve
Voltage power supply	24V minimum, 480V max and 600V on request
Input signal	SSR
Firing mode	Zero Crossing (ZC)
Auxiliary voltage supply	230 → 200÷230V ±15%; 10 VA power consumption 460 → 300÷460V ±15%; 10 VA power consumption
Fan voltage supply	230V ±15%; 110V ±15% on request
Fuses	Internal
Mounting	Bulk head mounting
Protection	IP20

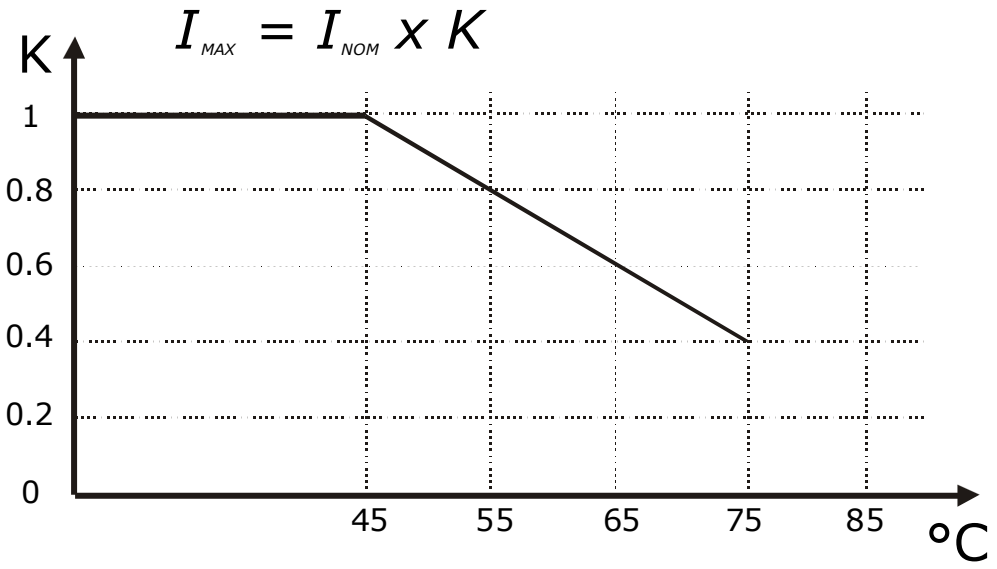
2.2 Input features

Input signal	**Maximum current drain**	**Input Impedance**	**ON condition**	**OFF condition**
SSR	5mA constant current		≥4V-max 30V	≤1V

2.3 Output features

Current	Voltage range	Ripetitive peak reverse voltage		Latching current	Max peak one cycle	Leakage current	I^2T value for fusing	Frequency range	Power loss	Isolation Voltage
(A)	(V)	(480V)	(600V)	(mAeff)	(10msec.) (A)	(mAeff)	tp=10msec.	(Hz)	I=Inom (W)	Vac
125	24÷600	1200	1600	450	2000	15	19100	47÷70	450	2500
150	24÷600	1200	1600	450	2000	15	19100	47÷70	540	2500
225	24÷600	1200	1600	300	4800	15	108000	47÷70	810	2500
300	24÷600	1200	1600	300	5250	15	128000	47÷70	1080	2500
350	24÷600	1200	1600	200	7800	15	300000	47÷70	1260	2500
400	24÷600	1200	1600	200	8000	15	306000	47÷70	1440	2500
450	24÷600	1200	1600	1000	17800	15	1027000	47÷70	1620	2500
500	24÷600	1200	1600	1000	17800	15	1027000	47÷70	1800	2500

2.4 Derating curve



2.5 Fans

The thyristor units are equiped with a fan. The fan supply must be protected with a fuse.
Fan voltage supply is standard 230VAC ±15% 50/60Hz or optional 110VAC ± 15% 50/60Hz.
The power consumption is given in the table below.

Size	CE **Number of fans**	c UL us LISTED **Number of fans**
125A, 150A	One Fan - 14W	One Fan - 14W
225A	Two Fans - 30W	Two Fans - 30W
300A, 400A, 500A	Four Fans - 60W	Four Fans - 60W
350A, 450A	Two Fans - 30W	Four Fans - 60W

3. Ordering information

Model CD3000S 3PH

	1	*2*	*3*	*4*	*5*	*6*	*7*
CD3000S-3PH							
Ex:CD3000S 3PH/	*150A/*	*400V/*	*480V/*	*460V/*	*SSR/*	*ZC/*	*UL*

1	**Nominal CURRENT of CD3000S**					
125A		300A		450A		
150A		350A		500A		
225A		400A				

2	**Operating Load Voltage (incoming voltage supply)**
Specify the value of the line supply.	

3	**Max VOLTAGE of CD3000S**
480V 600V	
The voltage on the identification label must be equal or more than operating voltage. The minimum voltage supply to the load is 24V.	

4	**Auxiliary Voltage**
230V	200÷230V ±15%; 10VA
460V	300÷460V ±15%; 10VA
600V	600V ±15%; 10VA (on request)

5	**Input**
SSR	4÷30VDC

6	**Firing**
ZC	Zero Crossing

7	**Options**
FAN110	Fan voltage supply 110VAC ± 15% (std 230VAC ± 15%) 14W 50/60Hz
UL	UL Certification

4. Installation and wiring information

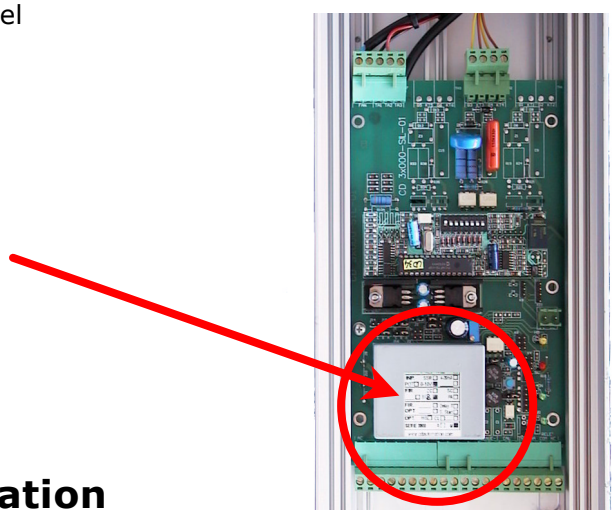
4.1 Identification of the unit

Before to install the CD3000S unit examine for damages or deficiencies. If any is found, notify the carrier immediately. Check that the product features shown on CD3000S identification label corresponds to that ordered.

An identification label provide all the informations regarding the factory settings of the unit. This label is on the board inside the unit, as represented below:

Identification Label

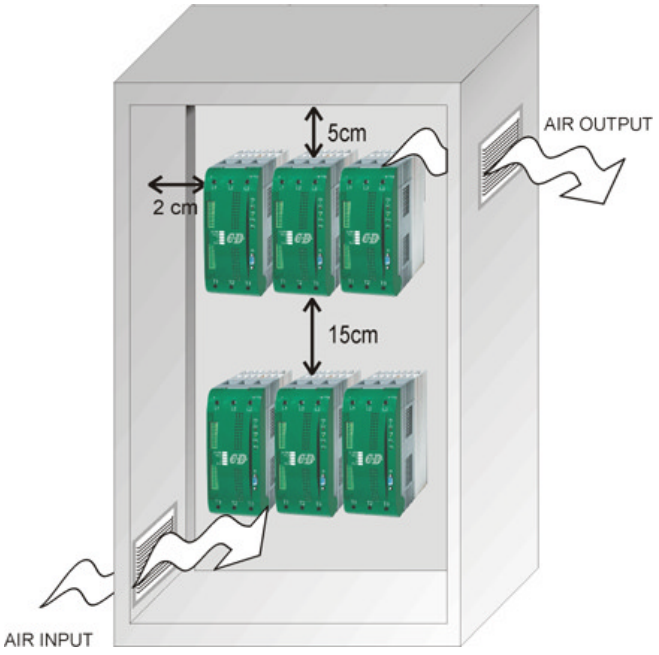
PHASES	1☐	2☐	3☐
AMPS	125☐	300☐	650☐
	150☐	350☐	720☐
	200☐	100☐	___☐
	225☐	450☐	
	275☐	500☐	
MAX V	480☐	600☐	___☐
OPERATING V			
AUX V	230☐	400☐	800☐
INP.	SSR☐		____☐
FIR.	ZC☐		____☐
OPT.	H3☐		____☐



4.2 Installation

CD3000S unit should be always mounted in vertical position to improve air cooling on heatsink. Maintain minimum distances in vertical and in horizontal as below represented. Don't install in proximity of hot elements and near units generating electromagnetic interferences.

When more units are mounted inside a cubicle provide air circulation as below represented.
Sometimes it is necessary to provide a fan to have better air circulation.

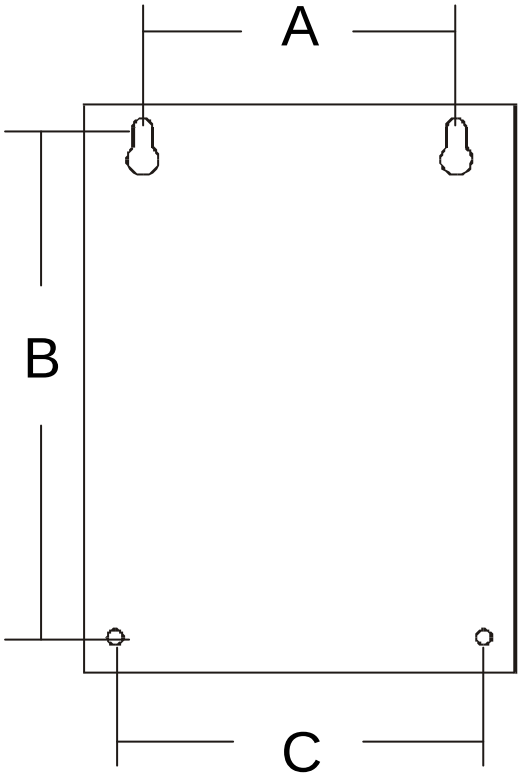


4.3 Dimensions

CD3000S 3PH 125-150A (S11)	CD3000S 3PH 225A (S13)	CD3000S 3PH 300A-500A (S14)

Size	W(mm)	H(mm)	D(mm)
125A (S11)	137	440	270
150A (S11)	137	440	270
225A (S13)	262	440	270
300A (S14)	262	520	270
350A (S14)	262	520	270
400A (S14)	262	520	270
450A (S14)	262	520	270
500A (S14)	262	520	270

4.4 Fixing Holes



Size	A(mm)	B(mm)	C(mm)
125A (S11)	97	415	97
150A (S11)	97	415	97
225A (S13)	222	415	222
300A (S14)	222	495	222
350A (S14)	222	495	222
400A (S14)	222	495	222
450A (S14)	222	495	222
500A (S14)	222	495	222

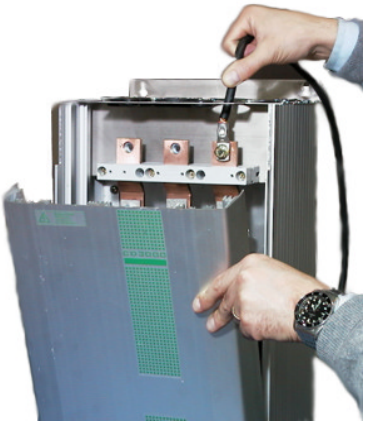
5. Wiring instructions

5.1 Removing the cover

To open the unit apply as follow.

For S11 size you must open the cover to configure the unit and to view the fuses

For S13 and S14 sizes, you must open the cover to cable, to configure the unit and to view the fuses



Warning: *this procedure can be done just by specialized personnel*

CD3000S unit has isolated heatsink. For safety connect the heatsink to hearth using its terminal with hearth symbol.

CD3000S can be susceptible to airborne interferences from near equipment or from interferences on main supply, so a number of precautions must be taken.

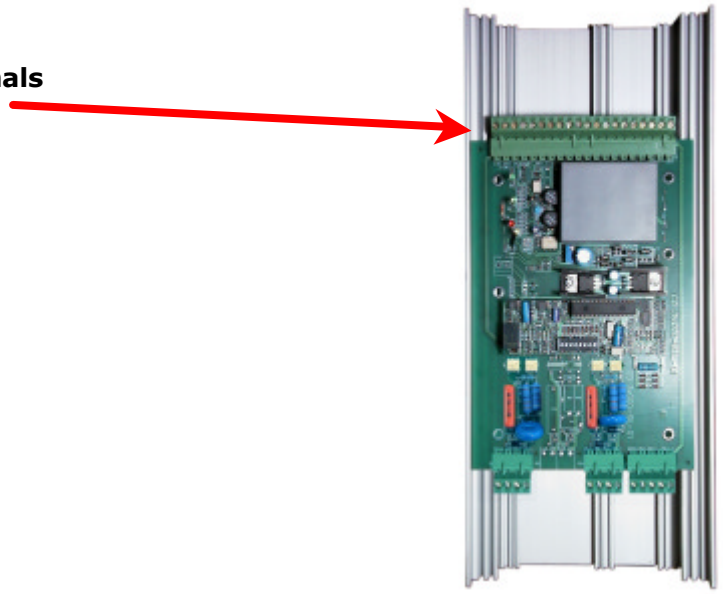
- Contactors coils and chokes must have in parallel a RC filter and must be supplied with a different voltage line.
- All input/output signal must use screened bifilar wires.
- Signal input and output must not routing in same cable try and must not be parallel.
- Local regulations regarding electrical installation should be rigidly observed.

5.1.1 Auxiliary Terminals

Before connect or disconnect, make sure that the power, control cables and wires are insulated from the voltage

Terminal	Description
1	Auxiliary supply voltage 230-460Vac (600V opt.)
2	N.C. not connected
3	Auxiliary supply voltage 230-460Vac (600V opt.)
4	N.C. not connected
5	Fan supply 230V (110V opt.)
6	Fan supply 230V (110V opt.)
7	Reset
8	Reset
9	+ Input command signal SSR
10	- Input command signal SSR
11	∅ Volt GND
12	Output + 8Vdc stabilized, 1mA max
13	+Output command signal to CD3000 slave
14	- Output command signal to CD3000 slave
15	Not used
16	Not used
17	Not used
18	Not used
19	Not used
20	Not used

Auxiliary terminals



5.1.2 Power Terminals

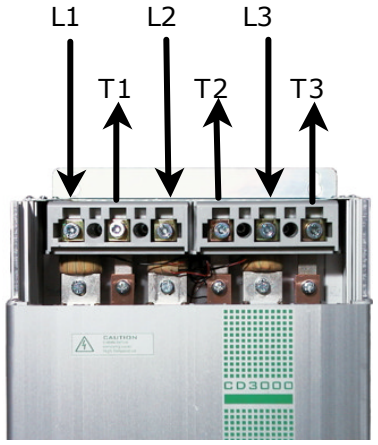
Before connect or disconnect, make sure that the power, control cables and wires are insulated from the voltage

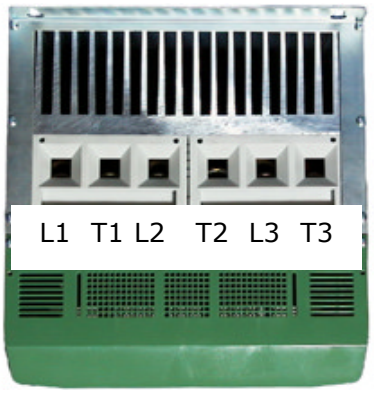
Terminal	Description
L1	**Line Input Phase 1**
T1	**Load Output Phase 1**
L2	**Line Input Phase 2**
T2	**Load Output Phase 2**
L3	**Line Input Phase 3**
T3	**Load Output Phase 3**

S14 power connection

S11 power connection

S13 power connection





5.2 Cabling detail

Use 75°C copper (CU) conductor only, provided with the terminal type indicated below.

<table>
<tr><th>Current/courant</th><th>Torque/couple
Lb-in (N-m)</th><th>Wire Range/cable</th><th>Wire
Terminal/terminal</th></tr>
<tr><td>125A, 150A,
225A</td><td>310 (35.0)</td><td rowspan="2">18 - 600kcmil</td><td>Polymeric Terminal
Block M8</td></tr>
<tr><td>300A</td><td>372 (42.0)</td><td>Bus Bar Adapter M8</td></tr>
<tr><td>350A, 400A</td><td rowspan="2">505 (57.0)</td><td rowspan="2">Bus Bar</td><td rowspan="2">Bus Bar Adapter M10</td></tr>
<tr><td>450A, 500A</td></tr>
</table>

Power terminals: wire details:

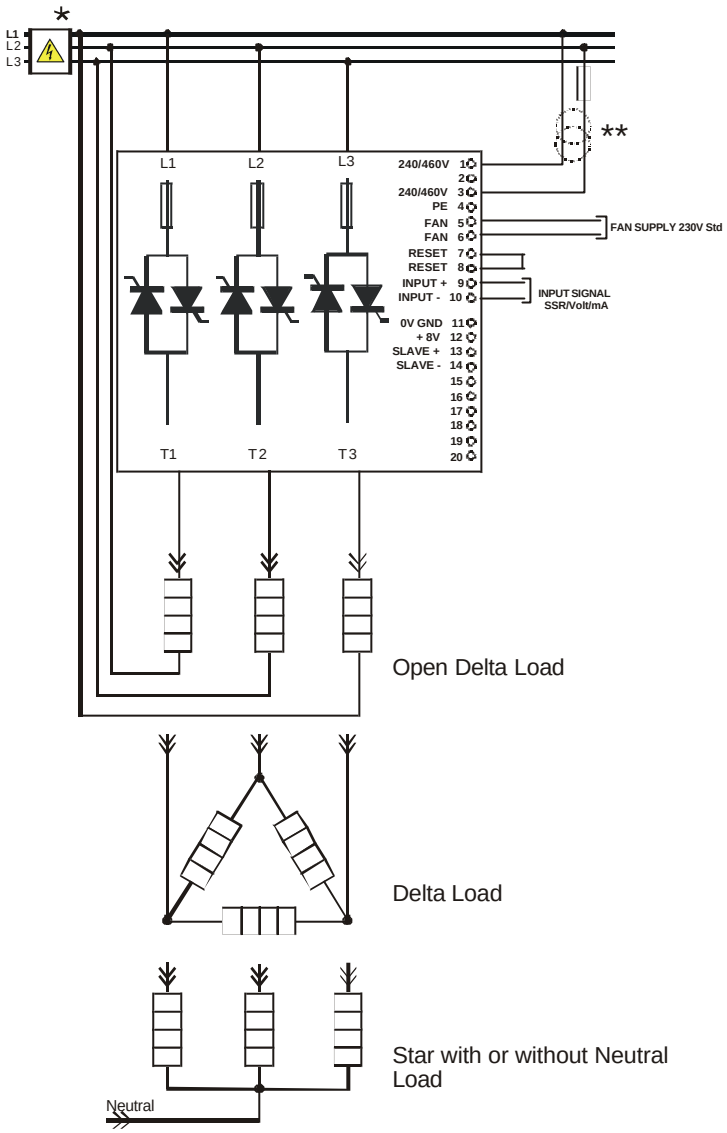
Current	**Supply L1, L2 and L3**			**Load T1, T2 and T3**		
	Cable		**Screw**	**Cable**		**Screw**
	mm²	**AWG**	**M**	**mm²**	**AWG**	**M**
125A	50	1	M8	50	1	M8
150A	70	1/0	M8	70	1/0	M8
225A	120	4/0	M8	120	4/0	M8
300A	2 x 70	2 x 1/0	M8	2 x 70	2 x 1/0	M8
350A	2 x 95	2 x 3/0	M10	2 x 95	2 x 3/0	M10
400A	2 x 95	2 x 3/0	M10	2 x 95	2 x 3/0	M10
450A	Bus Bar		30 x 6 mm	Bus Bar		30 x 6 mm
500A	Bus Bar		60 x 4 mm	Bus Bar		60 x 4 mm

Auxiliary connectors and earth:

Current	**Auxiliary Supply**			**Earth**		
	Cable			**Cable**		**Screw**
	mm²	**AWG**		**mm²**	**AWG**	**M**
125A	0,50	18		16	6	M6
150A	0,50	18		16	6	M6
225A	0,50	18		25	4	M8
300A	0,50	18		50	1	M8
350A	0,50	18		50	1	M8
400A	0,50	18		50	1	M8
450A	0,50	18		70	1/0	M8
500A	0,50	18		70	1/0	M8

5.3 Wiring connection

5.3.1 CD3000S 3PH 125-500A



NOTE: IMPORTANT

* The user installation must be protected by electromagnetic circuit breaker or by fuse isalator.
<u>** If the auxiliary voltage (written on the identification label) is different from supply voltage (to the load), use an external transformer, as reported above.</u>

To work terminals 7-8 must be linked.

Fan voltage supply is standard 230VAC ±15% 50/60Hz or optional 110VAC ±15% 50/60Hz. For power consumption see fan paragraph.

5.4 LED Status Table

LED	STATUS	DESCRIPTION
PW (green led)	◌	Auxiliary supply is not connect
	●	Auxiliary supply is connect
ON (green led)	◌	OFF Condition (Load IS NOT Powered)
	●	ON Condition (Load IS Powered)

◌	= Light OFF	●	= Light ON

6. Start up

Before to supply the thyristor unit:

- verify that load current equal or less than nominal;

For resistive load (star or delta)

$$I = \frac{P_{tot}}{V\sqrt{3}}$$

For resistive load open delta

$$I = \frac{P_{tot}}{3V}$$

- verify that there is no short circuit on load;
- verify that main voltage equal or less than nominal;
- verify that all auxiliary connections are right;
- fan voltage equal than nominal (230V std , 110V optional)

After which supply thyristor unit giving the maximum input signal and verify that load current is equal or less than thyristor unit nominal current.

Warning: *this procedure can be done just by specialized personnel.*

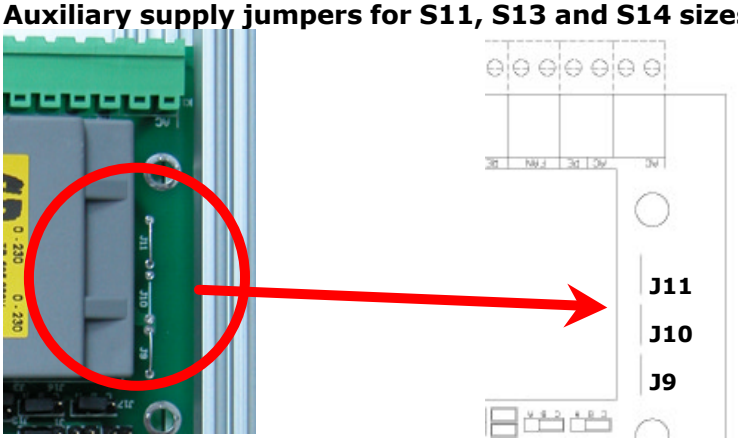
The thyristor unit is delivered configured and tuned in line with customer requirements. If it's necessary to change on site the configuration, procede as below specified.

6.1 Auxiliary supply

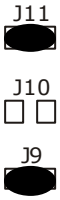
Warning: *this procedure can be done just by specialized personnel.*

To change auxiliary supply voltage sold the correct link-jumper on main PCB.

Auxiliary supply jumpers for S11, S13 and S14 sizes

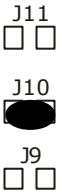


230V Auxiliary supply
To set the auxiliary power supply to 230V, close J9 and J11 and open J10 as shown below.



460V Auxiliary supply
To set the auxiliary power supply to 460V, close J10 and open J9 and J11 as shown below.

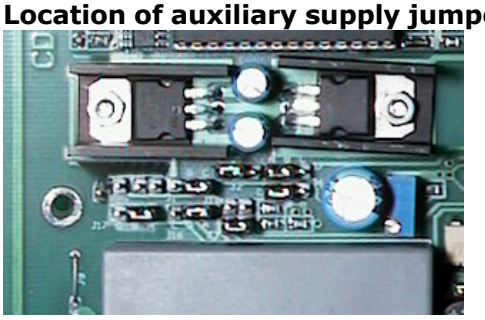
600V Auxiliary supply
This is a special version on request. In this case the unit is supplied already configured.

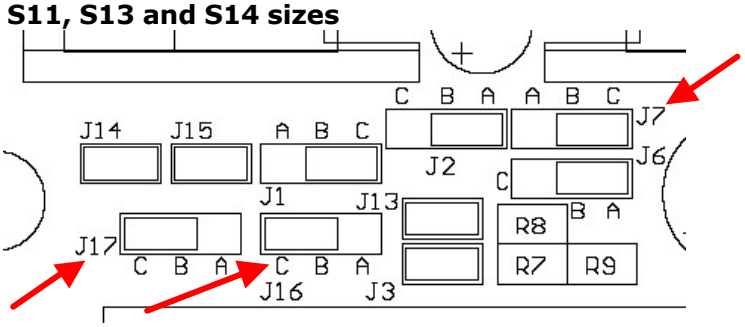


6.2 Input configuration

Warning: *this procedure can be done just by specialized personnel.*

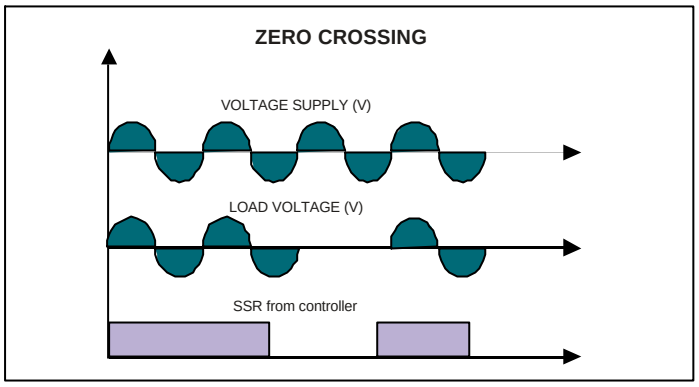
Location of auxiliary supply jumpers for S11, S13 and S14 sizes





Jumpers Configuration				
	MAIN PCB			
Input	**J7**	**J16**	**J17**	**J13**
SSR	A B C	C B A	C B A	FITTED

7. Thyristor firing mode



7.1 Zero Crossing(ZC)

ZC firing mode is used with Logic Output from temperature controllers and the Thyristor operate like a contactor. The Cycle time is performed by temperature controller. ZC minimize interferences because the Thyristor unit switch ON-OFF at zero voltage.

8. Fuses and fuseholder

8.1 Fuses and Fuse Code

CD3000S unit must be protected by fuses against short circuit selecting the proper I²t that must be lower than thyristor one. The same caution must be taken if Circuit Breaker is used. Remember that is very difficult to protect the thyristor if this choice is done.

WARNING!! Equipment short circuit protected by Semiconductor Fuse type with proper I^2t

Sizes	Bussmann Div - Cooper (UK) Ltd (200 kA_{RMS} Symmetrical A.I.C.)				Ferraz Shawmut SA (200 kA_{RMS} Symmetrical A.I.C.)			
	Fuse Mod. No. /modéle fusible	**Current (A_{RMS})**	**I^2t (A^2sec)**	**V ac**	**Fuse Mod. No. /modéle fusible**	**Current (A_{RMS})**	**I^2t (A^2sec)**	**Vac**
125A	2x 100 FE	100	2800	660	2 x 6,9 URY 17/100	100	3900	690
150A	2x 100 FE	100	2800	660	2 x 6,9 URY 17/100	100	3900	690
300A	450 FMM	450	105000	660	6,6 URZ 2X000 BS88 Z 450	450	126000	660
350A	550 FMM	550	215000	660	6,6 URZ 2X000 BS88 Z 550	550	208000	660
400A	550 FMM	550	215000	660	6,6 URZ 2X000 BS88 Z 550	550	208000	660
450A	700 FMM	700	420000	660	6,6 URZ 2x000 BS88 Z 700	700	340000	660
500A	700 FMM	700	420000	660	6,6 URZ 2x000 BS88 Z 700	700	340000	660
FERRAZ (200kA @ 660V)					SIBA (300kA @ 600V, 200kA @700V)			
225A	6,6 URB 000 BS88/315	315	82000	660	20 559 20	315	77000	660

High speed fuses are only used for the thyristor protection and can not be used to protect the installation.

The user installation must be protect by electromagnetic circuit breaker or by fuse isolator.

The warranty of thyristor is null if no proper fuses are used. See tab above.

9. Maintenance

9.1 Trouble Shooting

Small problems sometimes can be solved locally with the help of the below tab of trouble shooting. If you don't succeed, contact us or your nearest distributor.

Symptom	**LED Indication**	**Possible reasons of the symptom**	**Actions**
Thyristor unit doesn't go in conduction with input signal.	Green LED (PWR) is always light off.	No voltage auxiliary power supply to terminals 1-3 (see wiring diagram).	Give auxiliary voltage supply to terminals 1-3.
	Green LED (PWR) light on and green LED (ON) in off condition.	No input signal. Reversed polarities of input signal. Reset contact in open condition (see wiring diagram).	Provide to give input signal. Reverse the input signal polarity. Make link on reset terminals.
Load current flows also with no input signal.	Green LED (ON) always in off condition.	Short circuit on thyristor. Wrong connection.	Substitute the thyristor. Check that load is not in short circuit.

9.2 Repairing procedure

- Phone to us.
- Explain to Service Engineer the problem because sometimes it can be solved with a phone call.
- If this is not possible ship the unit to us or to your distributor.
- Write a fault description and give the name of your personnel to which refer.
- Use a rugged packaging to ship the unit.

9.3 Fans

The thyristor unit with forced ventilation uses fans that rotate permanently when the unit is supplied. In case of accidental fan failure, there is an over heating temperature on heatsink. In this case to give protection to thyristor there is a thermal switch properly setted. The function of this switch is to open the input signal until the heatsink temperature falls below the setted value. This means that also with input signal in ON condition the unit is switched OFF and the system can not work at full power. For these reason is important to control periodically the fan status checking that is rotating.

9.4 Servicing

In order to have correct cooling, the user must clean the heatsink and the protective grill of fan. The frequence of this servicing depends on environmental pollution.
Check periodically also if the screw for the power cables and safety earth are tightened correctly

9.5 Warranty conditions

We gives a 12 months warranty to its products. The warranty is limited to repairing and parts substitution in our factory and does exclude products not properly used and fuses.
Warranty does not includes products with serial numbers deleted. The faulty product should be shipped to us at your cost and our Service will evaluate if product is under warranty terms.
Substituted parts remains our property.

10. CD Automation's distributors

For a more precise and rapid service, please contact the distributor nearest to you:

ITALY	
CABE S.r.l. Via Ferrara, 15/17 40018 S. Pietro in Casale (BO) Tel: 051 6661345 Fax: 051 6661283 Sig. Bergonzoni info@cabesrl.it	**Vectra Misure S.r.l.** Via Gaidano, 109/17 10137 Torino (TO) Tel: 011 3097003 Fax: 011 3098799 Sig. Cochis vectramisure@libero.it
CEAM Control Equip. S.r.l. Via Val d'Orme, 291 50053 Empoli (FI) Tel: 0571 924181 Fax: 0571 924505 Sig. Campinoti info@ceamgroup.it	**Secif S.a.s.** Via Bachelet, 27 35010 Busa di Vigonza (PD) Tel: 049 8934422 Fax: 049 8934415 Sig. Ferro info@secif.com
Studio Rapaccini S.a.s. Via del Rivo, 138 05100 Terni (TR) Tel: 0744 305105 Cell: 335 6163428 Fax: 0744 305110 Dott. Rapaccini rapaccin@tin.it	

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